

Claims:

What is claimed is

- 1 1. A heterogeneous intersubband (HISB) optical device having a predetermined
2 function, said device comprising
3 a multiplicity of stacked intersubband (ISB) sub-devices, characterized in that
4 at least two of said sub-devices have different individual gain/loss profiles, , and
5 said individual gain/loss profiles are mutually adapted to generate said predetermined
6 function.
- 1 2. The invention of claim 1 wherein said sub-devices have a set of characteristic
2 parameters including the peak energy of the ISB transitions therein, the position of each sub-
3 device in the stack, the oscillator strengths of said transitions, the energy bandwidth of said
4 transitions, the length of said sub-devices, and the doping levels of said sub-devices, said
5 individual gain/loss profiles being determined by mutually adapting said parameters.
- 1 3. The invention of claim 1 wherein said HISB device is designed to operate in
2 conjunction with a second device having a gain/loss characteristic over a particular wavelength
3 range, said individual gain/loss profiles being mutually adapted to generate said predetermined
4 function as a gain/loss characteristic in said HISB device that compensates for said gain/loss
5 characteristic of said second device.
- 1 4. The invention of claim 1 wherein said HISB device is designed to operate in
2 conjunction with a second device having a nonlinear refractive index characteristic over a
3 particular wavelength range, said individual gain/loss profiles being mutually adapted to generate
4 said predetermined function such that said HISB device has a nonlinear refractive index
5 characteristic that compensates for said nonlinear refractive index characteristic of said second
6 device.
- 1 5. The invention of claim 1 wherein said individual gain/loss profiles are mutually
2 adapted to generate said predetermined function as a relatively flat gain/loss profile over a
3 particular wavelength range.

1 6. The invention of claim 1 wherein said HISB device comprises a laser for
2 simultaneously operating at a plurality of different wavelengths.

1 7. The invention of claim 6 further comprising a transmitter that includes said HISB
2 device, a utilization device for receiving radiation at said wavelengths generated by said HISB
3 device, and a transmission medium for optically coupling said transmitter to said receiver.

1 8. The invention of claim 6 wherein said individual gain/loss profiles are mutually
2 adapted to generate said predetermined gain/loss characteristic as a gain profile that exhibits
3 peaks at a multiplicity of said different wavelengths.

1 9. The invention of claim 8 wherein said transmitter and said receiver operate on the
2 basis of wavelength division multiplexing of a multiplicity of channels, and radiation at each of
3 said wavelengths emitted by said HISB device correspond to one of said channels. \

1 10. The invention of claim 1 wherein each of said ISB sub-devices includes a radiative
2 transition region and an injection/relaxation region adjacent thereto.

1 11. A heterogeneous intersubband (HISB) optical device having a predetermined
2 gain/loss profile, said device comprising
3 upper and lower cladding regions,
4 a core region including a multiplicity of intersubband (ISB) active regions stacked
5 between said cladding regions, each of said active regions including a plurality of radiative
6 transition regions and interleaved therewith a plurality of injection/relaxation regions,
7 means forming an optical cavity resonator, said active regions being located within said
8 resonator, characterized in that
9 at least two of said active regions are different from one another, said regions
10 having a set of characteristic parameters including the peak energy of the ISB transitions therein,
11 the position of each of said sub-devices in the stack, the oscillator strengths of said transitions,
12 the energy bandwidth of said transitions, the length of said active regions, and the doping levels

- 13** of said regions, and wherein said parameters are mutually adapted to generate said predetermined
- 14** gain/loss profile.